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Elytroderma Needle Blight of *Ponderosa* Pine

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The most important needle blight of ponderosa pine in the Pacific Northwest and parts of adjacent regions is caused by a native fungus, *Elytroderma deformans*. This disease also attacks Jeffrey pine and is occasionally found on other 2- and 3-needle pines.

Damage varies greatly in severity from place to place and from time to time. It is usually slight or moderate, even where the disease is common, but stands in widely separated localities are sometimes badly damaged during outbreak years.

Description

The fungus is perennial in bark of infected twigs and small branches, and invades most or all of the new needles soon after they appear. Infected needles are reddish brown during spring and early summer of their second year, forming conspicuous "flags" that permit easy detection of the disease. These needles gradually fade and become partly hidden behind new foliage, so that by late summer it is difficult to distinguish them at a distance from old needles that have faded preliminary to normal fall defoliation.

The characteristic dark, slender fruiting bodies of the fungus (fig. 1) first appear in the spring as faint lines on the convex (outer) surfaces of the red needles, and are plainly visible by late spring or early sum-

mer. They may, however, be small and sparse where needle vigor is low. When these fruiting bodies are present, the blight is readily distinguishable from other diseases of pine foliage. Spores ripen in late summer and fall, and are ejected when the needles are wet. Most of the infected needles then drop, but a few old bleached ones sometimes



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Figure 1.—Infected ponderosa pine needles, showing dark, slender fruiting bodies of the needle blight fungus *Elytroderma deformans*.



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Figure 2.—Witches'-brooms caused by needle blight on ponderosa pine.

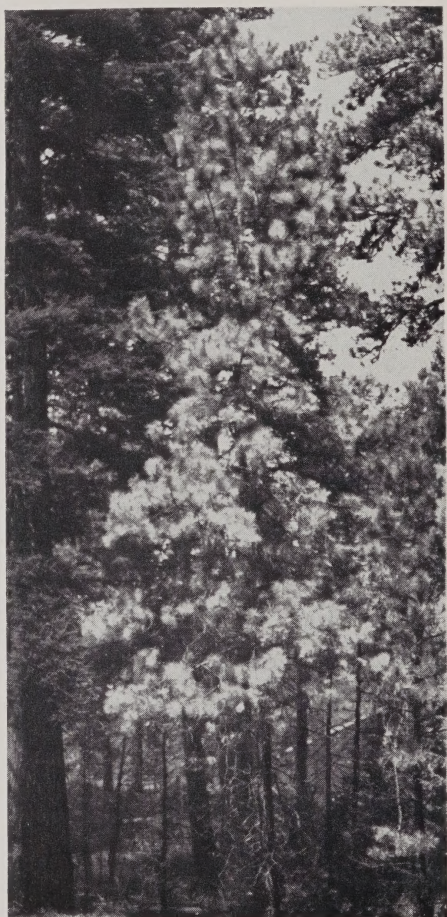
remain attached, with sooty, ragged remnants of fruiting bodies still visible upon them. Witches'-brooms, denser and more globose than those caused by dwarfmistletoe, often develop in crowns of trees of average or better vigor after several years of light to moderate infection (fig. 2).

Relation to Environment

Since dry spores cannot germinate, blight abundance probably depends largely on how often and how long the pine foliage is wet when living spores are present and temperatures are suitable for growth of the fungus. Local outbreaks characteristically start in sheltered situations, such as bottoms of draws. However, they may also occur along edges of meadows, or less frequently on middle and upper slopes, where moisture is available from heavy

dews, unusually frequent or persistent fogs, or condensation in ascending air currents. Infection is almost invariably most severe in partly shaded thickets of reproduction, in the interiors of groups of pole-size trees, and on the lower crowns and north to northwest sides of pole-size and larger trees (fig. 3). During the dry years of the 1930's, blight was rare, even in localities where it has since become common.

Except for this very general moisture relationship, little is known about the conditions that deter-



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Figure 3.—Needle blight infection is concentrated in the lower crown of this pole-size ponderosa pine. Foliage "flags," normally reddish brown, appear white in the photograph.

mine blight prevalence. Some infection probably occurs almost every year, especially during "wet cycles," but damaging intensities occur only when conditions are exceptionally favorable for the disease. Infection intensities tend to be highest in stands of moderate overstory density and at elevations intermediate in the altitudinal range of ponderosa pine. In central and eastern Oregon, infection is most severe at about 5,000 feet above sea level, presumably because lower elevations are too dry and higher elevations too cold for abundant infection to occur.

Effect

Damage by the disease is often overestimated because of the great contrast between blighted and healthy foliage in the spring. Blight is most injurious to trees with poor crowns, even though it is most conspicuous in good crowns. When the proportion of blighted foliage is low, damage is slight, regardless of how conspicuous the flags may be.

Where infection of mature trees is moderately severe (fig. 4), crowns become thin, ragged, or short, and trees are correspondingly reduced in vigor. Rapid and direct killing by blight is infrequent in such stands, and most of the trees will usually survive for at least several years. However, there is a gradual increase in mortality rate as weakened trees fall prey to bark beetles, root rots, and other enemies. This is the most common form of damage by the disease.

On mature trees that have been very severely infected for 2 or 3 years, foliage consists principally of needles produced during the preceding spring. These needles are usually stunted and pale, and die shortly before the next year's needles appear. Most such trees soon



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Figure 4.—Ponderosa pines with crowns thinned by needle blight. Several other diseases cause similar thinning of crowns.

die as a direct result of practically complete defoliation by the blight. This form of damage is common in only a few localities, but occasionally involves most of the trees on areas up to approximately a hundred acres in extent. Severely infected trees are seldom attacked by western pine beetles.

Infection on individual overstory trees of average vigor can be roughly classified according to its probable consequences as follows: *needles blighted on less than two-fifths of the twigs*—little or no injury; *needles blighted on two-fifths*

to four-fifths of the twigs—host weakened and more likely to be killed by western pine beetles or other parasites; *needles blighted on more than four-fifths of the twigs*—host likely to die soon as a direct result of defoliation by blight. The classification of individual trees within these ratings may change with changes in severity of infection; such changes, however, need be given little consideration in estimating the ultimate effect of the disease on a given tree. Large increases in infection severity are infrequent, and when they do occur they usually develop so rapidly that they have culminated by the time they are noticed. Recovery of mature trees appears to be a very slow process and is usually more apparent than real—that is, the flags disappear as affected twigs die, but lost foliage is replaced to only a small extent by growth elsewhere in the crown.

Killing and deforming in smaller size classes is restricted in most instances to crowded or suppressed trees of little value. Although lower branches or even entire lower crowns are often destroyed on vigorous young “crop” trees, the upper crowns of such trees usually are affected only slightly, and foliage losses are soon made good by new growth at the tops.

Control

Control of needle blight by direct methods, such as spraying, is not practicable at present. Damage can be reduced through accelerated harvesting of threatened values and probably also through stand improvement operations for maintenance and increase of vigor of potential crop trees in young stands.

Badly blighted stands should be logged promptly to forestall loss from rapid deterioration of killed

trees. Where blight damage consists largely of weakening rather than killing, logging is less urgent but may be necessary to prevent gradual mortality losses and build-up of western pine beetle populations. Salvage cuttings in moderately to severely infected stands have often been immediately followed by abnormally high mortality in the residual stands. Such cuttings, therefore, should remove all merchantable trees except those with high vigor and little or no infection. In making cut-or-leave decisions in lightly infected stands, markers should assume that trees with blighted foliage will die within a few years. Marking in blighted stands is most efficient during clear weather in spring and early summer, when blight flags are easily recognizable.

In stand improvement operations, crop trees should not be selected from those with blight present near the leader or common above mid-crown. Badly infected crowns should be pruned to prevent formation of loose knots, as branches are killed by the disease. Special effort should be made to give full release to crop trees.

References

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